Safety and Reliability

While various structural failures have captured national attention over the years, the events of September 11, 2001 generated a greatly increased awareness of vulnerabilities in our national infrastructure. The extent of these vulnerabilities depends to a large degree on the performance of materials in situations outside of the original design considerations. It is now recognized that a critical and urgent national need exists to establish the behavior of materials under such extreme loadings, and to disseminate guidance and tools to assess and reduce future vulnerabilities.

The goal of providing a technical basis for cost-effective changes to national practices and standards, coupled with a need for an integrated effort drawing on capabilities and expertise of a broad collaborative team, has lead to the development of the Safety and Reliability Program within MSEL. This program draws on the expertise of several divisions in MSEL and across NIST.

Project selection is guided by an identification and assessment of the particular vulnerabilities within our materials-based infrastructure, and focusing on those issues which would benefit strongly by improved measurements, standards, and materials data. Ultimately, we intend to moderate the effects of acts of terrorism, natural disasters, or other emergencies, all through improved use of materials.

Our vision is to be the key resource within the Federal Government for materials metrology development as realized through the following objectives:

- Identify and address vulnerabilities and needed improvements in U.S. infrastructure
- Develop and deliver standard measurements and data;
- Develop advanced measurement methods needed by industry to address new problems that arise with the development of new materials;
- Support other agency needs for materials expertise.

This program responds both to customer requests (primarily other government agencies) and to the Department of Commerce 2005 Strategic Goal of "providing the information and framework to enable the economy to operate efficiently and equitably." For example, engineering design can produce safe and reliable structures only when the property data for the materials is available and accurate. Equally importantly, manufacturers and their suppliers need to agree on how material properties should be measured.

The Safety and Reliability Program works toward solutions to measurement problems on scales ranging from the macro to the micro, in three of the Laboratory's Divisions (Materials Reliability, Metallurgy, and Polymers). The scope of activities includes the development and innovative use of state-of-the-art measurement systems; leadership in the development of standardized test procedures and traceability protocols; development of an understanding of materials in novel conditions; and development and certification of Standard Reference Materials (SRMs). Many of the tests involve extreme conditions, such as high rates of loading, high temperatures, or unusual environments (*e.g.*, deep underwater). These extreme conditions often produce physical and mechanical properties that differ significantly from the handbook values for their bulk properties under traditional conditions. These objectives will be realized through innovative materials, property measurement and modeling.

The MSEL Safety and Reliability Program is also contributing to the development of test method standards through committee leadership roles in standards development organizations such as the ASTM International and the International Standards Organization (ISO). In many cases, industry also depends on measurements that can be traced to NIST Standard Reference Materials (SRM®).

In addition to the activities above, all three divisions provide assistance to various government agencies on homeland security and infrastructural issues. Projects include assessing the performance of structural steels as part of the NIST World Trade Center Investigation, advising the Bureau of Reclamation on metallurgical issues involving pipelines and dams, advising the Department of the Interior on the structural integrity of the U.S.S. Arizona Memorial, and collaborating with both the Department of Transportation and the Department of Energy on pipeline safety issues.